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EVALUATION OF CARDIOPROTECTIVE ACTIVITY OF *SOLANUM TORVUM* IN ISOPROTERENOL INDUCED RATS

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ABSTRACT

Objective: To evaluate the cardioprotective effect hydroethanolic extract of *solanum torvum* against isoproterenol induced myocardial infarction in Wistar rats. **Methods:** In this study, cardioprotective effect hydroethanolic extract of *solanum torvum* (at the dosage of 200 mg/kg body weight for 30 days) against isoproterenol induced rats were studied and also compared with standard drug Propranolol. MI was induced with a single dose of ISO (85 mg/kg) on the 29th and 30th day. At the end of 30 days (i.e., on the day 31st), serum and heart tissues were collected and lipid profiles such as cholesterol, triglycerides, LDL and HDL were estimated in serum. Histopathology of heart samples was also performed. **Results:** Administration of ISO in control rats showed a significant increase serum Total Cholesterol (TC), Triglycerides (TG), low density lipoprotein (LDL) and decrease in High density lipoprotein (HDL). Rats treated with hydroethanolic extract of *solanum torvum* (200 mg/kg body weight) showed decreased TC, TG, LDL and increases HDL levels. The histopathological studies also showed that Plant extract significantly minimized the damage induced by isoproterenol. **Conclusion:** Thus, *solanum torvum* provide cardioprotection against isoproterenol induced myocardial infarction in rats.

KEYWORDS: *Solanum torvum*, Isoproterenol, Myocardial infarction, Propranolol.

INTRODUCTION

Myocardial infarction (MI) is the acute condition at necrosis of the myocardium that occurs as a result of imbalance between coronary blood supply and myocardial demand.[1] Myocardial infarction (MI) is an irreversible necrosis of tissue of a region of the myocardium

caused by ischemia. The evidence of MI can be identified by elevations of different proteins released into the blood by the damaged myocytes.[2] Myocardial infarction and the resultant complication in cardiac function represent the leading cause of morbidity and mortality with advanced life style in developing countries like India particularly in metropolitan cities. Myocardial infarction is making increasingly important contribution to mortality in developing countries.[3] Cardiovascular disease (CVD) remains the principal cause of death in developed and developing countries, claiming 17.1 million lives a year. According to world health organization it is predicted that CVD will be the most important cause of mortality in India by 2020.[4] Isoproterenol [1-(3, 4- dinydropheny1)-2- isopropylamino ethanol hydrochloride] (ISO) a synthetic catecholamine and β-adrenergic agonist, is documented to cause severe oxidative stress in the myocardium and resulting in infarct like necrosis of the heart muscle.[5] Administration of isoproterenol is known to produce free radicals that cause severe damage to the myocardial membrane and enzymatic changes suggestive of myocardial ischemia in experimental animals.[6] Antioxidants constitute the fore most defence system that limits the toxicity related to free radicals. The balance between antioxidant and free radicals is an important process for the effective removal of oxidative stress in intracellular organelles.

Solanum torvum (solanaceae) is a plant used in Cameroonian folk medicine for the treatment of fever, wounds and tooth decay. This plant is also used for its haemostatic properties.[7] Recent investigations demonstrated that S*olanum torvum* has antimicrobial activity.[8] Importantly isoflavonoids isolated from this plant showed significant antiviral properties.[9]

MATERIALS AND METHODS

PLANT MATERIAL COLLECTION

The fresh leaves of *solanum torvum* were collected from local areas Coimbatore and the plant was authenticated (No.BSI/SRC/5/23/2015/Tech/2565) by Botanical survey of India, Southern Regional Centre, Coimbatore, India.

PRERPARATION OF *Solanum Torvum* EXTRACT

The leaves of *Solanum torvum* was collected from the local areas of Coimbatore, Tamilnadu. About 1 kg of leaf of *Solanum torvum* was dried by shade drying method at room temperature and ground to a coarse powder. The coarse powder of the leaf was used for the preparation of the extract.

The coarse powder of *Solanum torvum* leaves were soaked in 50% ethanol and cold macerated for three days. The suspension was filtered through a fine muslin cloth. The residue was removed. The filtrate was evaporated to dryness at a low temperature in a rotatory evaporator. When needed, the residual extracts were dissolved in distilled water and given for animal for cardioprotective study.

DRUGS AND CHEMICALS

Isoproterenol was purchased from sigma chemical Co., USA. Propranolol (standard drug) was purchased from a pharmacy.

ANIMALS

Male wister rats weighing 100-150 g procured from laboratory animal house, Bangalore was used for the present study. The ethical clearance (CPCSEA/No.313/2015/IAEC) for handling of experimental animals was obtained from the Institutional Animal Ethics Committee (IAEC). The animals were maintained under standard laboratory conditions with controlled temperature and humidity, where they were allowed to get acclimatized to standard laboratory diet and filtered water. They were kept at constant room temperature 37˚C, 12 hours day and night cycle. The place where the experiments were conducted was kept very hygienic.

INDUCTION OF MYOCARDIAL INFARCTION

Isoproterenol (ISO) 85 mg/kg was dissolved in physiological saline solution and was injected subcutaneously to rats for 2 consecutive days to induce experimental myocardial infarction (29^{th} and 30^{th} day).

EXPERIMENTAL DESIGN

The rats were randomly divided into 4 groups of 3 animals in each group.

TABLE 1 : EXPERIMENTAL SETUP

GROUPS	EXPERIMENTAL SETUP
GROUP I	Normal rats
GROUP II	MI Induced rats (Isoproterenol 85 mg/ kg)
GROUP III	MI Induced rats+ Propranolol (10 mg/kg)
GROUP IV	MI Induced rats + 200 mg /kg of *Solanum torvum* leaf extract

Isoproterenol (ISO) was injected on 29^{th} and 30^{th} day and on the next day (31^{st} day) animals were sacriticed by cervical dislocation and blood was collected through cardiac puncture and

heart tissues were excised immediately, rinsed in ice-chilled saline and stored at -80^0 C till further use for the biochemical estimations and histopathological analysis.

BIOCHEMICAL ESTIMATION FROM SERUM

The collected serum was used for the estimation for Total Cholesterol (TC), Triglycerides (TG), High Density Lipoprotein (HDL) and low density lipoprotein (LDL) using commercially available (autospan diagnostic) kits.[10]

HISTOPATHOLOGICAL STUDIES

At the end of the study, all the rats were sacrificed by chloroform anesthesia and the heart was excised out and washed in saline (0.9% NaCl). The tissues wew immediately fixed in 10% buffered formalin solution. After fixation, tissues were embedded in paraffin and serial sections were cut and each section was stained using hematoxylin and eosin.[11, 12] Then the slides were viewed under microscope at different magnifications.

RESULTS

Iso induced myocardial infracted rats showed a significant increase in the levels of serum cholesterol, triglycerides and LDL. *Solanum torvum* pretreatment significantly decreased the levels of total cholesterol, triglycerides and LDL in the serum of ISO induced myocardial infracted rats. As deplicated in Table 1 and Figure 2.

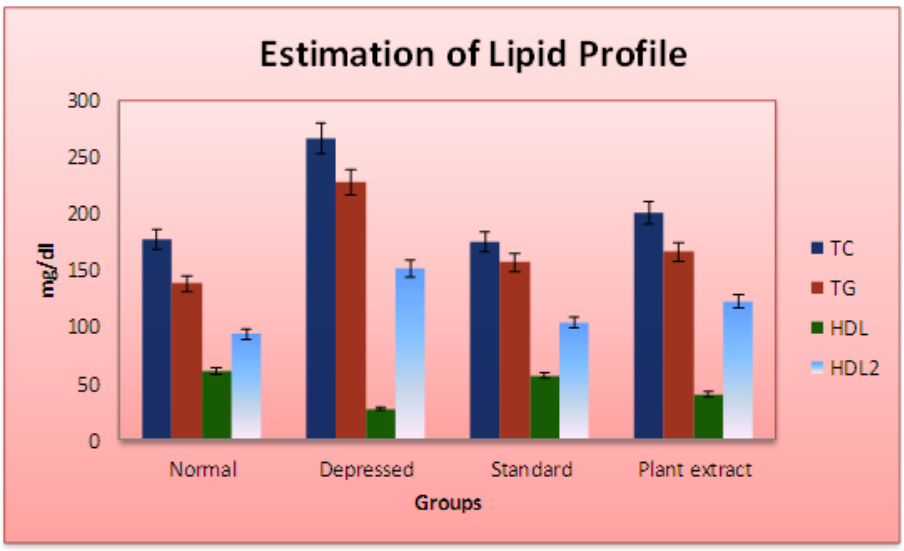

Figure 1: Effect of *Solanum xanthocarpum* Levels of total cholesterol, Triglycerides, HDL and LDL in serum of control and experimental rats

TABLE 2: Effect of solanum torvum on Triglycerides, cholesterol, HDL, LDL levels.

GROUPS	Triglycerides	Total Cholesterol	HDL	LDL
Normal (Group I)	122.65±1.21	148.66±0.73	62.62±0.78	85.66±2.45
ISO (Group II)	210.89±0.99*	243.56±0.73*	25.67±1.13*	156.67±0.79*
Drug Treated(Group III)	151.87±0.77*	148.45±1.22*	46.66±0.77*	104.5±1.20*
Plant Extract (Group IV)	178.82±0.84*	170.66±0.91*	33.65±1.09*	121.66±0.59*

ISO induced myocardial infracted rats revealed a significant decrease in the level of serum HDL (table1).Pretreatment with *solanum torvum* significantly increased the level of serum HDL in ISO induced myocardial infracted rats. As depicated in Figure 2.

HISTOPATHOLOGICAL INVESTIGATIONS

Histopathological observation of heart in normal group showed normal architecture of heart and no inflammatory cell infiltration was seen. Disease control rats showed necrosis, edema and infiltration of inflammatory cells.

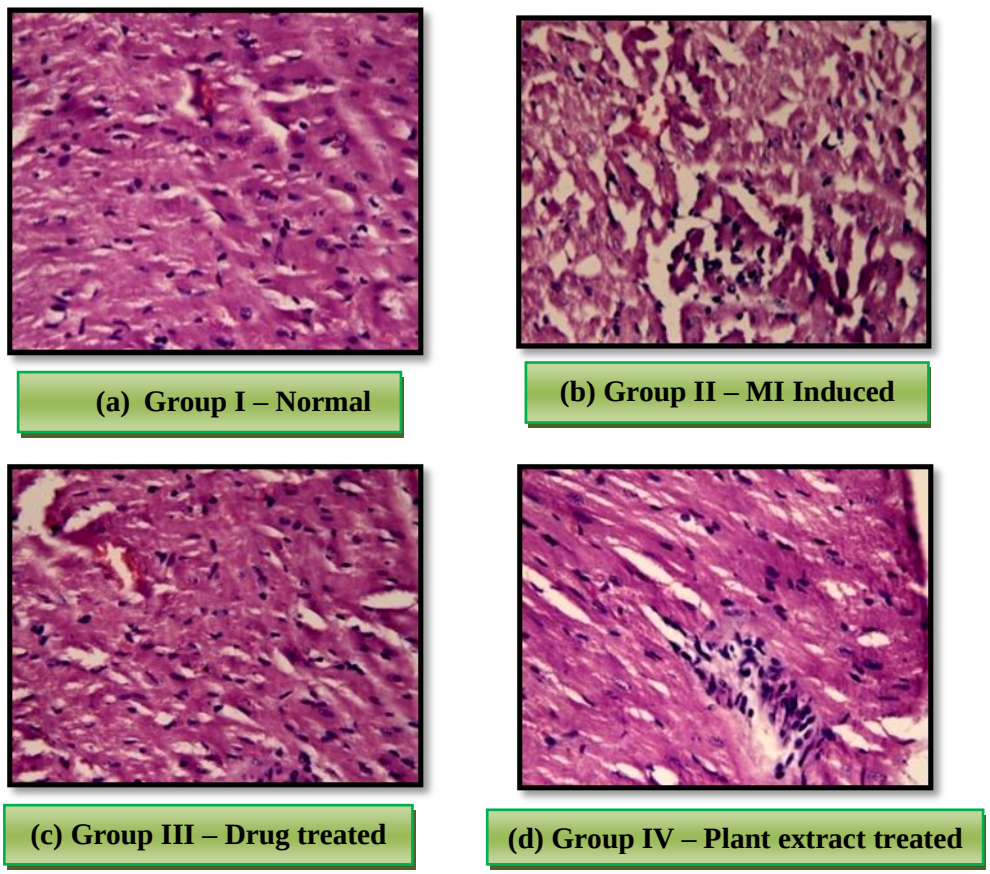

Figure 2: Histopathological observation of heart, (a) Group I: Normal architecture of heat, (b) Group II (ISO induced): Severe tissue degeneration and necrosis, (c) Group III (Propranolol): Mild tissue degeneration and necrosis, (d) Group IV (*Solanum torvum* extract): Moderate tissue degeneration and necrosis

Propranolol treated rats showed reduced mild tissue degeneration and *solanum torvum* treated rats showed moderate tissue degeneration and necrosis.

DISCUSSION

Myocardial infarction (MI) is one of the main causes of death from cardiovascular diseases (CVD). Lipids plays an important role in cardiovascular diseases, not only in hyperlipidemia and the development of atherosclerosis, but by modifying the composition, structure and stability of the cellular membrane.[13] The increased myocardial cholesterol content observed in ISO induced myocardial infracted rats is because of increased uptake of LDL from the blood by myocardial membranes.[14] Prior treatment with *solanum torvum* significantly decreased the levels of cholesterol, Triglycerides, LDL and increased the levels of HDL in ISO induced myocardial infracted rats. Histopathological studies were carried out for the confirmations of biochemical findings. The histopathological studies gave a clear view of the cardiac damage in the isoproterenol treated rats and those affected tissues were recovered by the administration of *Solanum torvum* leaf extract. Thus *Solanum torvum* has some protective effect on myocardium against isoproterenol.

CONCLUSION

In Conclusion, the study reveals that *solanum torvum* has strong antioxidant activity and it can maintain cell membrane integrity and improve cardiac systolic/diastolic dysfunction induced by isoproterenol. The findings proved that the plant is more effective in reducing the extent of myocardial damage and significantly counteracted reduced oxidative stress in Isoproterenol - induced myocardial infarction in rats. Thus, our study clearly indicated a significant cardioprotective activity of hydroethanolic extract of *Solanum torvum.*

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